# UTILITY PATENT APPLICATION TRANSMITTAL

*(Only for new nonprovisional applications under 37 CFR 1.53(b))*

| | |
|---|---|
| *Attorney Docket No.* | 862.C1824 |
| *First Named Inventor or Application Identifier* | |
| HIROSHI TOJO | |
| *Express Mail Label No.* | |

## APPLICATION ELEMENTS

*See MPEP chapter 600 concerning utility patent application contents.*

**ADDRESS TO:** Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

1. [ ] Fee Transmittal Form *(Submit an original, and a duplicate for fee processing)*
2. [X] Specification — *Total Pages* 25
3. [X] Drawing(s) *(35 USC 113)* — *Total Sheets* 7
4. [X] Oath or Declaration — *Total Pages* 1
   - a. [ ] Newly executed (original or copy)
   - b. [X] Unexecuted for information purposes
   - c. [ ] Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional with Box 17 completed)* ***[Note Box 5 below]***
     - i. [ ] DELETION OF INVENTOR(S) Signed Statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. [ ] Incorporation By Reference *(useable if Box 4c is checked)* The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4c, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. [ ] Microfiche Computer Program *(Appendix)*
7. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   - a. [ ] Computer Readable Copy
   - b. [ ] Paper Copy (identical to computer copy)
   - c. [ ] Statement verifying identity of above copies

### ACCOMPANYING APPLICATION PARTS

8. [ ] Assignment Papers (cover sheet & document(s))
9. [ ] 37 CFR 3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
10. [ ] English Translation Document *(if applicable)*
11. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
12. [ ] Preliminary Amendment
13. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
14. [ ] Small Entity Statement(s) [ ] Statement filed in prior application Status still proper and desired
15. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. [ ] Other: _____

17. If a CONTINUING APPLICATION, *check appropriate box and supply the requisite information:*
    [ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No. __/_____

### 18. CORRESPONDENCE ADDRESS

[X] Customer Number or Bar Code Label — 05514 (Insert Customer No. or Attach bar code label here) or [ ] Correspondence address below

| | | | | | |
|---|---|---|---|---|---|
| NAME | | | | | |
| Address | | | | | |
| City | | State | | Zip Code | |
| Country | | Telephone | | Fax | |

+

| CLAIMS | (1) FOR | (2) NUMBER FILED | (3) NUMBER EXTRA | (4) RATE | (5) CALCULATIONS |
|---|---|---|---|---|---|
| | TOTAL CLAIMS (37 CFR 1.16(c)) | 19-20 = | 0 | X $ 18.00 = | $ -0- |
| | INDEPENDENT CLAIMS (37 cfr 1.16(b)) | 3-3 = | 0 | X $ 78.00 = | $ -0- |
| | MULTIPLE DEPENDENT CLAIMS (if applicable) (37 CFR 1.16(d)) | | | $260.00 = | $ -0- |
| | | | | BASIC FEE (37 CFR 1.16(a)) | $690.00 |
| | | | Total of above Calculations = | | $690.00 |
| | Reduction by 50% for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28). | | | | |
| | | | | TOTAL = | $690.00 |

19. Small entity status
    - a. ☐ A Small entity statement is enclosed
    - b. ☐ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
    - c. ☐ Is no longer claimed.

20. ☒ A check in the amount of $ 690.00 to cover the filing fee is enclosed.

21. ☐ A check in the amount of $ _____ to cover the recordal fee is enclosed.

22. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 06-1205:
    - a. ☒ Fees required under 37 CFR 1.16.
    - b. ☐ Fees required under 37 CFR 1.17.
    - c. ☐ Fees required under 37 CFR 1.18.

| ***SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED*** | |
|---|---|
| NAME | Jack M. Arnold - Reg. No. 25823 |
| SIGNATURE | Jack M. Arnold |
| DATE | February 11, 2000 |

NY_MAIN 61000 v 1

# TITLE OF THE INVENTION

# IMAGE PROCESSING APPARATUS AND METHOD, AND COMPUTER-READABLE MEMORY

## FIELD OF THE INVENTION

This invention relates to an image processing apparatus and method for processing a moving picture, and to a computer-readable memory storing the program code for this processing.

## BACKGROUND OF THE INVENTION

When only a specific scene (a part of a TV program that begins from a specific title screen of the program, or a scene in which a specific person appears) is to be extracted from a plurality of moving-picture materials gathered by a video camera or VTR, etc., the user searches for the desired scene by repeatedly fast-forwarding or playing back each moving-picture material, writes down the time code of each scene and creates a list of time codes. Then, on the basis of the created list of time codes, the user performs an editing operation such as gathering specific scenes together and combining them into one moving picture.

However, in order to extract a specific scene from a plurality of moving-picture materials, the operator must perform the manual operations of fast-forward and

playback, search for the desired scene and create the list of time codes. This requires a great deal of time and labor.

## SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to provide an image processing apparatus, method and computer-readable memory which make it possible to extract a desired scene from a plurality of moving-picture materials in an efficient manner.

According to the present invention, the foregoing object is attained by providing an image processing apparatus for processing a moving picture, comprising: frame extraction means for extracting frames constituting an entered moving picture; discrimination means for discriminating a scene change by comparing frames extracted by the frame extraction means; storage means for storing scene-change information relating to the scene change discriminated by the discrimination means; designating means for designating an image that corresponds to a scene that is the object of a search; comparison means for comparing a scene-change frame, which is obtained by referring to the scene-change information that has been stored in the storage means, and the image that has been designated by the

designation means; and scene extraction means for extracting a scene that corresponds to the image based upon result of the comparison performed by the comparison means.

The foregoing object is attained by providing an image processing method for processing a moving picture, comprising: a frame extraction step of extracting frames constituting an entered moving picture; a discrimination step of discriminating a scene change by comparing frames extracted at the frame extraction step; a storage step of storing scene-change information relating to the scene change discriminated at the discrimination step; a designating step of designating an image that corresponds to a scene that is the object of a search; a comparison step of comparing a scene-change frame, which is obtained by referring to the scene-change information that has been stored at the storage step, and the image that has been designated at the designation step; and a scene extraction step of extracting a scene that corresponds to the image based upon result of the comparison performed at the comparison step.

The foregoing object is attained by providing a computer-readable memory storing program code of image processing for processing a moving picture, the memory including: program code of a frame extraction step of

extracting frames constituting an entered moving picture; program code of a discrimination step of discriminating a scene change by comparing frames extracted at the frame extraction step; program code of a storage step of storing scene-change information relating to the scene change discriminated at the discrimination step; program code of a designating step of designating an image that corresponds to a scene that is the object of a search; program code of a comparison step of comparing a scene-change frame, which is obtained by referring to the scene-change information that has been stored at the storage step, and the image that has been designated at the designation step; and program code of a scene extraction step of extracting a scene that corresponds to the image based upon result of the comparison performed at the comparison step.

Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the figures thereof.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram illustrating the

construction of an image processing apparatus according to an embodiment of the present invention;

Fig. 2 is a block diagram illustrating the functional construction of an image processing apparatus according to an embodiment of the present invention;

Fig. 3 is a flowchart illustrating the procedure of scene-change detection processing according to an embodiment of the present invention;

Fig. 4 is diagram illustrating an example of block division of a frame according to an embodiment of the present invention;

Fig. 5 is diagram illustrating an example of scene-change information according to an embodiment of the present invention;

Fig. 6 is a flowchart illustrating the procedure of scene extraction processing according to an embodiment of the present invention; and

Fig. 7 is a diagram showing an example of a list of extracted scenes according to an embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will now be described in derail with reference to the accompanying drawings.

Fig. 1 is a block diagram illustrating the construction of an image processing apparatus according to a preferred embodiment of the present invention.

As shown in Fig. 1, the apparatus includes a CPU 101 for implementing various control operations regarding various components of the image processing apparatus; a ROM 102 for storing a booting program, which is run when the image processing apparatus is started up, and various data; a RAM 103 which stores a control program run by the CU 101 and which provides a working area when various control operations are executed; a keyboard 104 and a mouse 105 for providing an environment that allows a user to make various inputs; an external storage device 106 constituted by a hard disk, floppy disk or CD-ROM; a display unit 107 constituted by a CRT or LCD or the like which displays the results of processing for the user; a network interface controller (NIC) 108 for making possible communication with various devices on a network; a video interface (I/F) 109 that makes it possible to capture a moving picture from a video camera 110 or VTR 112; and a bus 111 for interconnecting the above-mentioned components.

It should be noted that the video camera 110, VTR 112 and external storage device 106 may be replaced by components connected to the network.

The functions of the image processing apparatus according to this embodiment will be described with reference to Fig. 2.

A moving-picture input unit 201 is for inputting a moving picture captured from the video camera 110 or VTR 112 via the video interface 109 or a moving picture downloaded from the network via the NIC 108. A frame extraction unit 202 successively extracts frames (images), which constitute the entered moving picture, in regular order. A frame storage unit 209 stores frames extracted by the frame extraction unit 202. A scene-change discrimination unit 203 examines each frame to discriminate a scene change in a moving picture using an interframe-similarity calculation unit 204. The latter calculates the degree of similarity between frames. A scene-change information storage unit 205 stores information relating to a scene changes that has been discriminated by the scene-change discrimination unit 203. A pattern image designation unit 206 allows the user to designate a pattern image using the keyboard 104 and mouse 105. A scene extraction unit 207 uses the interframe-similarity calculation unit 204 to compare the pattern image that has been designated by the pattern image designation unit 206 with a frame, in which a scene change has occurred, obtained by referring to the scene-change information storage unit 205, and

extracts a desired scene corresponding to the pattern image. An extracted-scene list display unit 208 causes the display unit 107 to display a list of information relating to scenes extracted by the scene extraction unit 207.

An example of operation of the image processing apparatus having the scene extraction function of this embodiment arranged as set forth above will now be described.

[Scene-change detection processing]

Processing for detecting a change in scene will be described with reference to Fig. 3.

Fig. 3 is a flowchart illustrating the procedure of scene-change detection processing according to this embodiment of the present invention.

First, a moving picture to undergo processing is input by the moving-picture input unit 201 at step S301. Next, at step S302, the frame extraction unit 202 executes processing for extracting one frame at a time from the entered moving picture. Then, at step S303, the frame extraction unit 202 stores the extracted frames in the frame storage unit 209.

It is determined at step S304 whether all frames of the entered moving picture have been extracted. If all frames have not been extracted ("NO" at step S304), steps S302 and S303 are repeated. If all frames have

been extracted ("YES" at step S304), then control proceeds to step S305.

Step S305 calls for the scene-change discrimination unit 203 to use the interframe-similarity calculation unit 204 to perform, in numerical order, an interframe-similarity calculation between a frame of interest and a group of past frames. There are instances where the group of past frames is a single frame or a plurality of frames, and there is no particular limitation upon the algorithm.

The simplest example will now be described. First, the immediately preceding frame and the current frame are each divided into a plurality of blocks vertically and horizontally, as shown in Fig. 4. Next, average values of R, G and B are calculated in regard to each block. This is followed by obtaining the sum of the squares of the differences between the corresponding R, G and B channels in the preceding and current frames. This sum of the squares is taken as interframe similarity, which represents the degree of intensity of the scene change. The smaller the value of the sum of the squares, the greater the similarity between frames; the larger the value, the smaller the similarity. In other words, this is a method of obtaining an instance in which the possibility of a scene change is high. A example of the calculation formula is as follows:

$$\sum_{i=1}^{k} [(P1_{iR}-P2_{iR})^2 + (P1_{iG}-P2_{iG})^2 + (P1_{iB}-P2_{iB})^2]$$

where i represents the block undergoing processing, and

K : number of blocks into which the frame is divided;

$P1_{iR}$: average value of R channel of ith block of preceding frame;

$P1_{iG}$: average value of G channel of ith block of preceding frame;

$P1_{iB}$: average value of B channel of ith block of preceding frame;

$P2_{iR}$: average value of R channel of ith block of current frame;

$P2_{iG}$: average value of G channel of ith block of current frame;

$P2_{iB}$: average value of B channel of ith block of current frame

On the basis of the result of calculation of interframe similarity, the scene-change discrimination unit 203 determines whether or not there has been a scene change. If there has not been a scene change ("NO" at step S306), control proceeds to step S308. If there has been a scene change ("YES" at step S306), on the other hand, then, at step S307, the ID of the entered moving picture, the ID of the scene change and the frame are stored as the scene starting frame and the

similarity (or distance) representing the degree of intensity of the scene change is stored. These items of information shall be referred to as "scene-change information". An example of scene-change information is illustrated in Fig. 5. This information is stored in the scene-change information storage unit 205.

Next, at step S308, it is determined whether all frames of the moving picture have been discriminated for scene change. If all frames have not undergone scene-change discrimination ("NO" at step S308), processing from step S305 to step S307 is repeated until all scene-change frames of the moving picture and the similarity information are obtained. If all frames have undergone scene-change discrimination ("YES" at step S308), on the other hand, then processing is exited.

The foregoing is processing for detecting scene changes and is applied to all moving pictures that are to undergo scene extraction.

[Scene extraction processing]

Reference will be had to Fig. 6 to describe processing for designating a pattern image and extracting a desired scene.

Fig. 6 is a flowchart illustrating the procedure of scene extraction processing according to this embodiment of the present invention.

The user designates a pattern image using the

pattern image designation unit 206 at step S501. The pattern image designated is the image that represents the lead frame of a scene (e.g., the title screen of a specific part of a TV program). One conceivable method of designating the pattern image is for the user to create an image that resembles the lead frame of the scene. Next, at step S502, the scene extraction unit 207 regards the pattern image, which has been designated by the pattern image designation unit 206, as being a frame, and uses the interframe-similarity calculation unit 204 to calculate the degree of similarity between this frame and the already detected scene-change frame. Though the method of calculating similarity is not particularly limited, one conceivable method is that mentioned in the scene-change detection processing described above. The scene extraction unit 207 extracts the scene-change frame from the frame storage unit 209 upon referring to the ID of the moving picture and the starting frame of the scene-change information in the scene-change information storage unit 205.

Next, at step S503, the scene extraction unit 207 determines whether the pattern image is a frame identical with the scene-change frame based upon the degree of similarity calculated by the interframe-similarity calculation unit 204. If the frames are not identical ("NO" at step S503), control proceeds to step

S505. If the frames are identical ("YES" at step S503), on the other hand, then, at step S504, the ID of the moving picture is output to the extracted-scene list display unit 208 as well as the scene-change frame, which serves as the starting frame of a scene, and the frame (which will serve as the end frame of the scene) that immediately precedes the next scene-change frame. An example of a list of the extracted scenes is shown in Fig. 7.

Next, at step S505, it is determined whether all scene-change frames have been compared with the pattern image. If all scene-change frames have not been compared with the pattern image ("NO" at step S505), steps S502 to S504 are repeated to extract scenes that begin with those frames of all scene-change frames that are identical with the pattern image. If all scene-change frames have been compared with the pattern image ("YES" at step S505), then control proceeds to step S506. This is followed by step S506, at which the extracted-scene list display unit 208 causes the list of extracted scenes (Fig. 7) to be displayed for the user.

This concludes scene extraction processing.

Thus, in accordance with this embodiment, as described above, scene changes in an input moving picture can be detected automatically and the user, merely by designating a pattern image, can automatically

extract a frame of a scene, which corresponds to the pattern image. As a result, the user need not perform such operations as detection of scenes and creation of a time-code list, thus making it possible to perform operations such as editing in an efficient manner.

[Other embodiments]

In the embodiment described above, all frames are extracted and stored through steps S302 to S304, after which discrimination of a change in scene is performed at steps S305 to S308. However, it is permissible to adopt an arrangement in which discrimination of scene change is performed successively whenever a frame is extracted, and only the necessary frames (the scene-change frames, etc.) are stored in memory.

Further, though the list of extracted scenes (Fig. 7) per se is displayed for the user, it may be so arranged that the extracted scenes are edited into a single moving picture based upon the scene list and the scene list is displayed for the user. Alternatively, a printer may be connected to the apparatus to output the moving picture on a recording medium.

Further, a method in which the user creates the pattern image has been described as the method of designating the pattern image. However, it is permissible to adopt an arrangement in which scene-change frames extracted in scene-change detection are

displayed for the user and the user selects a frame from these selected frames as the pattern image. It may also be so arranged that the selection is made from a group of other images that have been prepared in advance.

Further, though only one scene that starts from a frame resembling the pattern image is extracted in the foregoing embodiment, it may be so arranged that the user can designate the number of scenes, thereby making it possible to extract a designated number of scenes that start with a frame resembling the pattern image. It is permissible to designate a number of frames with regard to frames prior to and with regard to frames on and after a frame resembling the pattern image.

Further, though only one scene that starts from a frame resembling the pattern image is extracted in the foregoing embodiment, it may be so arranged that the user can designate scene length (time), thereby making it possible to deduce time from the number of frames of a scene based upon scene-change information and extract a scene of a designated length that begins with the frame resembling the pattern image. It is permissible to designate scene length (time) with regard to frames prior to and with regard to frames on and after a frame resembling the pattern image.

Only one scene that starts from a frame resembling the pattern image is extracted in the foregoing

embodiment. However, if the frame immediately preceding a scene-change frame is extracted from the scene-change information and compared with the pattern image at step S502, then it will be possible to extract a scene that ends with a frame resembling the pattern image.

Again, only one scene that starts from a frame resembling the pattern image is extracted in the foregoing embodiment. However, if the pattern image is compared with all frames, a similar frame is found and a scene in which this frame is present is obtained by referring to the scene-change information, then it will be possible to extract a scene containing a frame resembling the pattern image.

As described above, this embodiment enables user to automatically extract a frame, which corresponds to the pattern image, that is the leading, intermediate or final frame of a scene. In addition, extracted scenes can be combined into a single moving picture automatically.

The present invention can be applied to a system constituted by a plurality of devices (e.g., a host computer, interface, reader, printer, etc.) or to an apparatus comprising a single device (e.g., a copier or facsimile machine, etc.).

Furthermore, it goes without saying that the object of the invention is attained by supplying a storage

medium storing the program codes of the software for performing the functions of the foregoing embodiments to a system or an apparatus, reading the program codes with a computer (e.g., a CPU or MPU) of the system or apparatus from the storage medium, and then executing the program codes.

In this case, the program codes read from the storage medium implement the novel functions of the invention, and the storage medium storing the program codes constitutes the invention.

Further, the storage medium, such as a floppy disk, hard disk, optical disk, magneto-optical disk, CD-ROM, CD-R, magnetic tape, non-volatile type memory card or ROM can be used to provide the program codes.

Furthermore, besides the case where the aforesaid functions according to the embodiments are implemented by executing the program codes read by a computer, it goes without saying that the present invention covers a case where an operating system or the like running on the computer performs a part of or the entire process in accordance with the designation of program codes and implements the functions according to the embodiments.

It goes without saying that the present invention further covers a case where, after the program codes read from the storage medium are written in a function expansion board inserted into the computer or in a

memory provided in a function expansion unit connected to the computer, a CPU or the like contained in the function expansion board or function extension unit performs a part of or the entire process in accordance with the designation of program codes and implements the function of the above embodiment.

In a case where the present invention is applied to the above-mentioned storage medium, program code corresponding to the flowcharts of Figs. 3 and 6 described earlier would be stored on the storage medium.

Thus, in accordance with the embodiments of the present invention as described above, it is possible to provide an image processing apparatus, method and computer-readable memory through which a desired scene can be extracted from a plurality of moving-picture materials in an efficient manner.

As many apparently widely different embodiments of the present invention can be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.

WHAT IS CLAIMED IS:

1. An image processing apparatus for processing a moving picture, comprising:

frame extraction means for extracting frames constituting an entered moving picture;

discrimination means for discriminating a scene change by comparing frames extracted by said frame extraction means;

storage means for storing scene-change information relating to the scene change discriminated by said discrimination means;

designating means for designating an image that corresponds to a scene that is the object of a search;

comparison means for comparing a scene-change frame, which is obtained by referring to the scene-change information that has been stored in said storage means, and the image that has been designated by said designation means; and

scene extraction means for extracting a scene that corresponds to the image based upon result of the comparison performed by said comparison means.

2. The apparatus according to claim 1, wherein said comparison means includes computation means for computing degree of similarity between the scene-change frame and the image that has been designated by said designation means;

wherein said scene extraction means extracts the scene corresponding to said image based upon results of calculation performed by said calculation means.

3. The apparatus according to claim 1, further comprising output means for outputting scene information relating to scenes that have been extracted by said scene extraction means.

4. The apparatus according to claim 3, wherein said output means edits scenes that have been extracted by said scene extraction means and combines these extracted scenes into a single moving picture.

5. The apparatus according to claim 1, wherein said designating means designates a pattern image that corresponds to any of a leading, intermediate or final frame of a scene that is the object of a search.

6. The apparatus according to claim 1, wherein said designating means is capable of designating a number of scenes to be extracted.

7. The apparatus according to claim 1, wherein said designating means is capable of designating the time of a scene to be extracted.

8. The apparatus according to claim 1, wherein said designating means is capable of designating a number of scenes to be extracted, with regard to frames prior to and with regard to frames on and after a frame corresponding to the pattern image.

9. The apparatus according to claim 1, wherein said designating means is capable of designating time of a scene to be extracted, with regard to frames prior to and with regard to frames on and after a frame corresponding to the pattern image.

10. An image processing method for processing a moving picture, comprising:

a frame extraction step of extracting frames constituting an entered moving picture;

a discrimination step of discriminating a scene change by comparing frames extracted at said frame extraction step;

a storage step of storing scene-change information relating to the scene change discriminated at said discrimination step;

a designating step of designating an image that corresponds to a scene that is the object of a search;

a comparison step of comparing a scene-change frame, which is obtained by referring to the scene-change information that has been stored at said storage step, and the image that has been designated at said designation step; and

a scene extraction step of extracting a scene that corresponds to the image based upon result of the comparison performed at said comparison step.

11. The method according to claim 10, wherein said

comparison step includes a computation step of computing degree of similarity between the scene-change frame and the image that has been designated at said designation step;

wherein said scene extraction step extracts the scene corresponding to said image based upon results of calculation performed at said calculation step.

12. The method according to claim 10, further comprising an output step of outputting scene information relating to scenes that have been extracted at said scene extraction step.

13. The method according to claim 12, wherein said output means edits scenes that have been extracted at said scene extraction step and combines these extracted scenes into a single moving picture.

14. The method according to claim 10, wherein said designating step designates a pattern image that corresponds to any of a leading, intermediate or final frame of a scene that is the object of a search.

15. The method according to claim 10, wherein said designating step is capable of designating a number of scenes to be extracted.

16. The method according to claim 10, wherein said designating step is capable of designating the time of a scene to be extracted.

17. The method according to claim 10, wherein said

designating step is capable of designating a number of scenes to be extracted, with regard to frames prior to and with regard to frames on and after a frame corresponding to the pattern image.

18. The method according to claim 10, wherein said designating step is capable of designating time of a scene to be extracted, with regard to frames prior to and with regard to frames on and after a frame corresponding to the pattern image.

19. A computer-readable memory storing program code of image processing for processing a moving picture, the memory including:

program code of a frame extraction step of extracting frames constituting an entered moving picture;

program code of a discrimination step of discriminating a scene change by comparing frames extracted at said frame extraction step;

program code of a storage step of storing scene-change information relating to the scene change discriminated at said discrimination step;

program code of a designating step of designating an image that corresponds to a scene that is the object of a search;

program code of a comparison step of comparing a scene-change frame, which is obtained by referring to

the scene-change information that has been stored at said storage step, and the image that has been designated at said designation step; and

program code of a scene extraction step of extracting a scene that corresponds to the image based upon result of the comparison performed at said comparison step.

ABSTRACT OF THE DISCLOSURE

Frames constituting an input moving picture are extracted by a frame extraction unit, the extracted frames are compared and scene changes in the moving picture are discriminated by a scene-change discrimination unit. Scene-change information relating to specific scene changes is stored in a scene-change information storage unit. An image corresponding to a scene that is the object of a search is designated from a pattern-image designation unit. The designated image is compared with scene-change frames obtained by referring to the scene-change information that has been stored in the scene-change storage unit, and a scene corresponding to the image is extracted by a scene extraction unit based upon results of the comparison.

FIG. 1

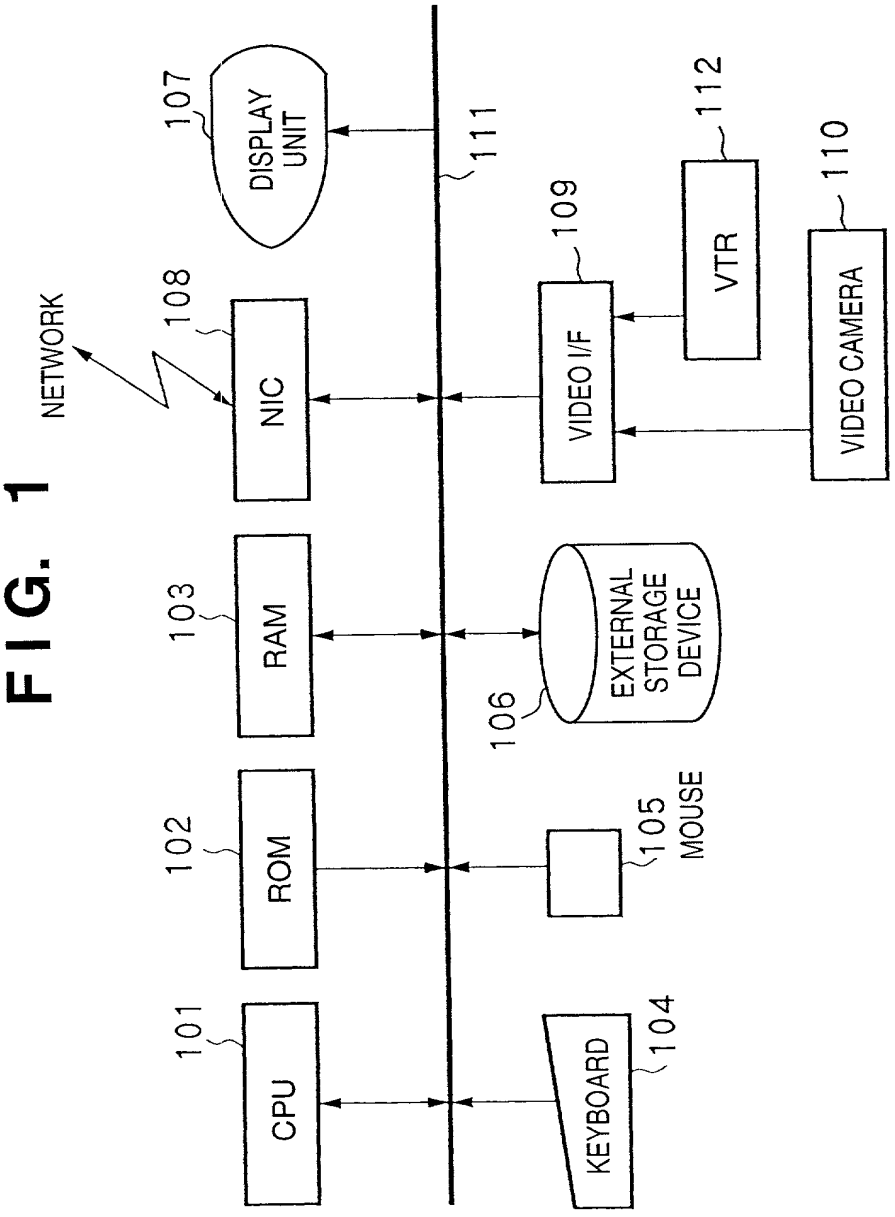

NETWORK
107
DISPLAY UNIT
108
NIC
111
109
VIDEO I/F
112
VTR
110
VIDEO CAMERA
103
RAM
106
EXTERNAL STORAGE DEVICE
102
ROM
105
MOUSE
101
CPU
KEYBOARD
104

FIG. 2

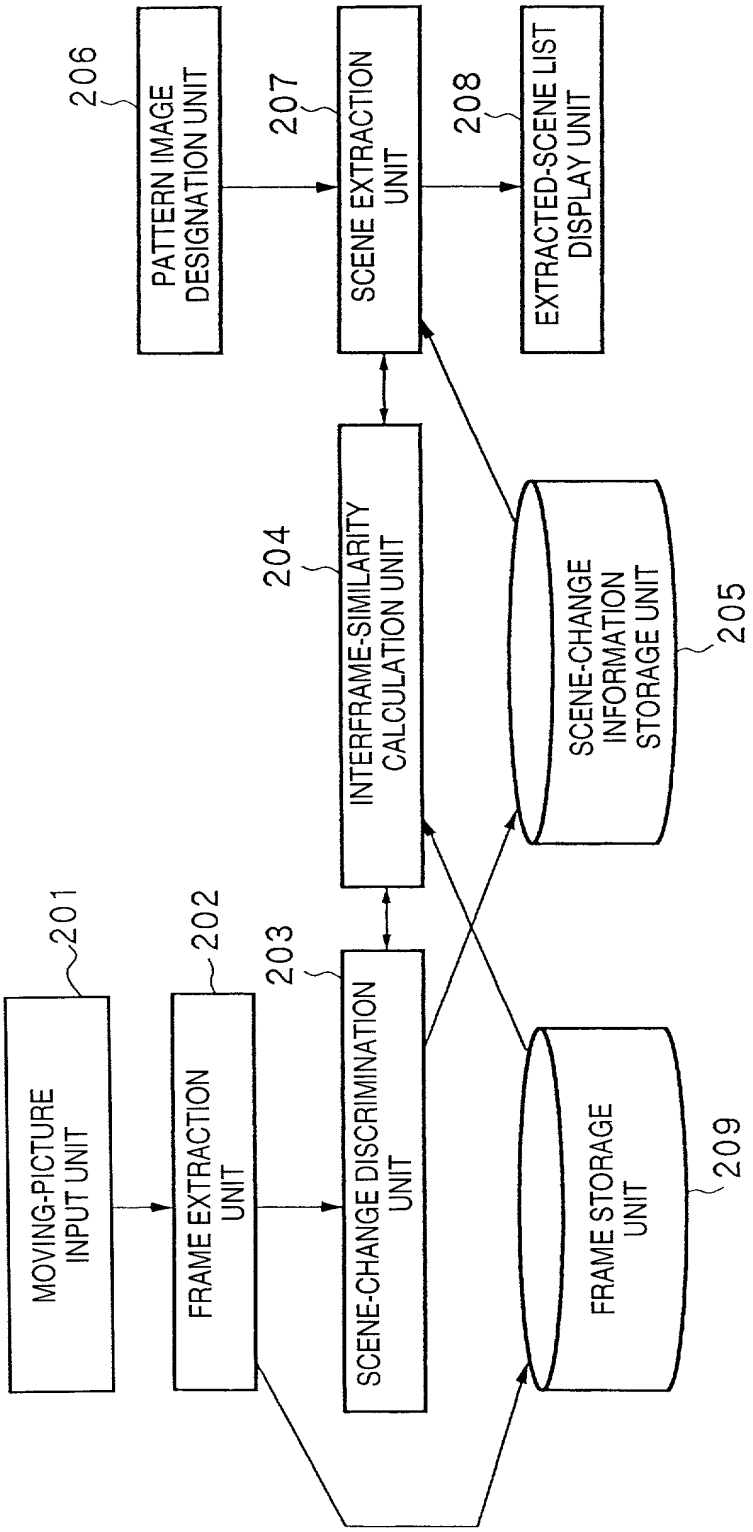

MOVING-PICTURE INPUT UNIT
201
FRAME EXTRACTION UNIT
202
SCENE-CHANGE DISCRIMINATION UNIT
203
INTERFRAME-SIMILARITY CALCULATION UNIT
204
SCENE-CHANGE INFORMATION STORAGE UNIT
205
FRAME STORAGE UNIT
209
PATTERN IMAGE DESIGNATION UNIT
206
SCENE EXTRACTION UNIT
207
EXTRACTED-SCENE LIST DISPLAY UNIT
208

FIG. 3

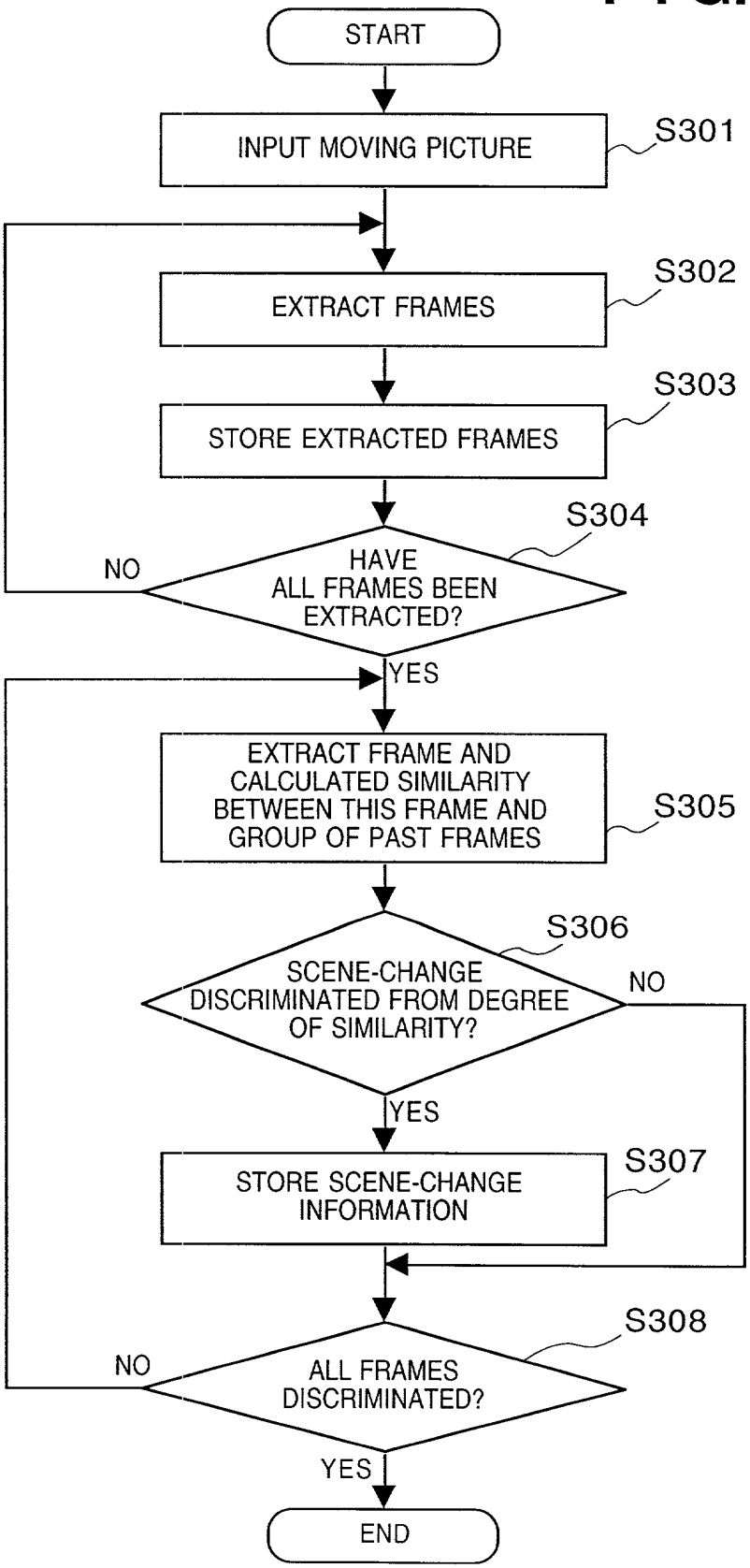
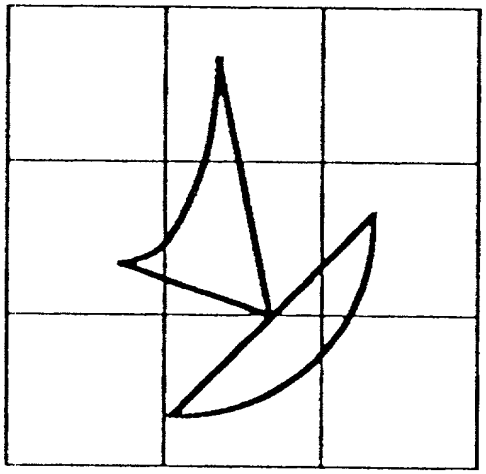

START
INPUT MOVING PICTURE
S301
EXTRACT FRAMES
S302
STORE EXTRACTED FRAMES
S303
HAVE ALL FRAMES BEEN EXTRACTED?
S304
NO
YES
EXTRACT FRAME AND CALCULATED SIMILARITY BETWEEN THIS FRAME AND GROUP OF PAST FRAMES
S305
SCENE-CHANGE DISCRIMINATED FROM DEGREE OF SIMILARITY?
S306
NO
YES
STORE SCENE-CHANGE INFORMATION
S307
ALL FRAMES DISCRIMINATED?
S308
NO
YES
END

FIG. 4

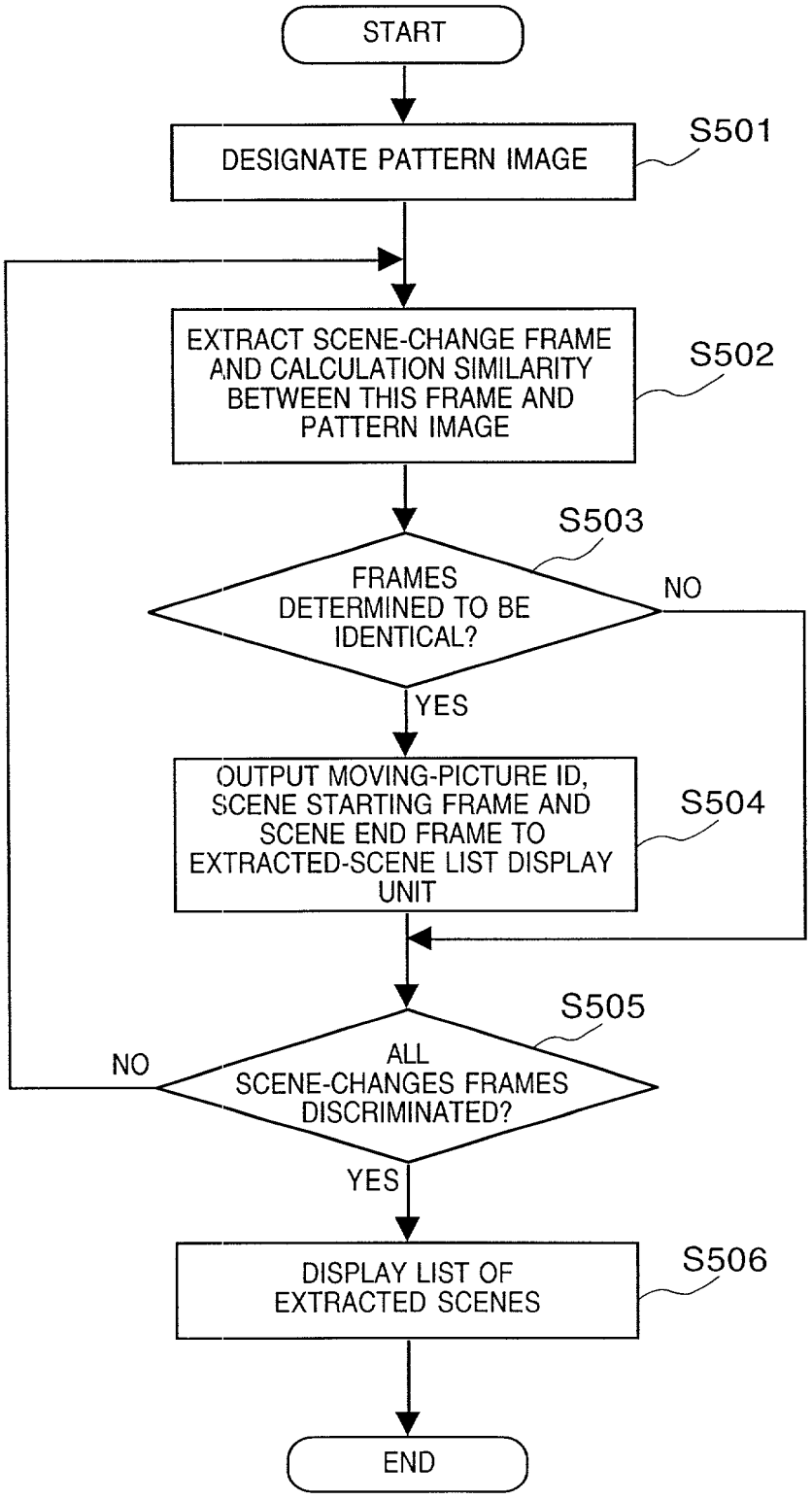


06.1720 9216356

FIG. 5

| ID OF MOVING PICTURE | ID OF SCENE CHANGE | STARTING FRAME | INTENSITY OF SCENE CHANGE |
|---|---|---|---|
| 0 | 0 | 0 | 90 |
| 0 | 1 | 10 | 50 |
| 0 | 2 | 16 | 80 |

FIG. 6


START
DESIGNATE PATTERN IMAGE
S501
EXTRACT SCENE-CHANGE FRAME AND CALCULATION SIMILARITY BETWEEN THIS FRAME AND PATTERN IMAGE
S502
S503
FRAMES DETERMINED TO BE IDENTICAL?
NO
YES
OUTPUT MOVING-PICTURE ID, SCENE STARTING FRAME AND SCENE END FRAME TO EXTRACTED-SCENE LIST DISPLAY UNIT
S504
S505
ALL SCENE-CHANGES FRAMES DISCRIMINATED?
NO
YES
DISPLAY LIST OF EXTRACTED SCENES
S506
END

EP 1 376 395 A2

FIG. 7

| ID OF MOVING PICTURE | STARTING FRAME | END FRAME |
|---|---|---|
| 0 | 10 | 15 |
| 0 | 20 | 34 |
| 1 | 15 | 38 |

**COMBINED DECLARATION AND POWER OF ATTORNEY**
**FOR PATENT APPLICATION**
(Page 1)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled IMAGE PROCESSING APPARATUS AND METHOD, AND COMPUTER-READABLE MEMORY

the specification of which [X] is attached hereto [ ] was filed on _____ as United States Application No. or PCT International Application No. _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b), of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designates at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed:

| Country | Application No. | Filed (Day/Mo./Yr.) | (Yes/No) Priority Claimed |
|---|---|---|---|
| Japan | 11-036512 | February 15, 1999 | Yes |

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

| Application No. | Filed (Day/Mo./Yr.) | Status (Patented, Pending, Abandoned) |
|---|---|---|

I hereby appoint the practitioners associated with the firm and Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and direct that all correspondence be addressed to the address associated with that Customer Number:

**FITZPATRICK, CELLA, HARPER & SCINTO**
**Customer Number: 05514**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole or First Inventor HIROSHI TOJO

Inventor's signature _____

Date _____ Citizen/Subject of Japan

Residence 35-3-102, Miyoshicho 3-chome, Fuchu-shi, Tokyo, Japan

Post Office Address CANON KABUSHIKI KAISHA

30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, Japan